

Does El Niño Intensity Matter for California Precipitation?

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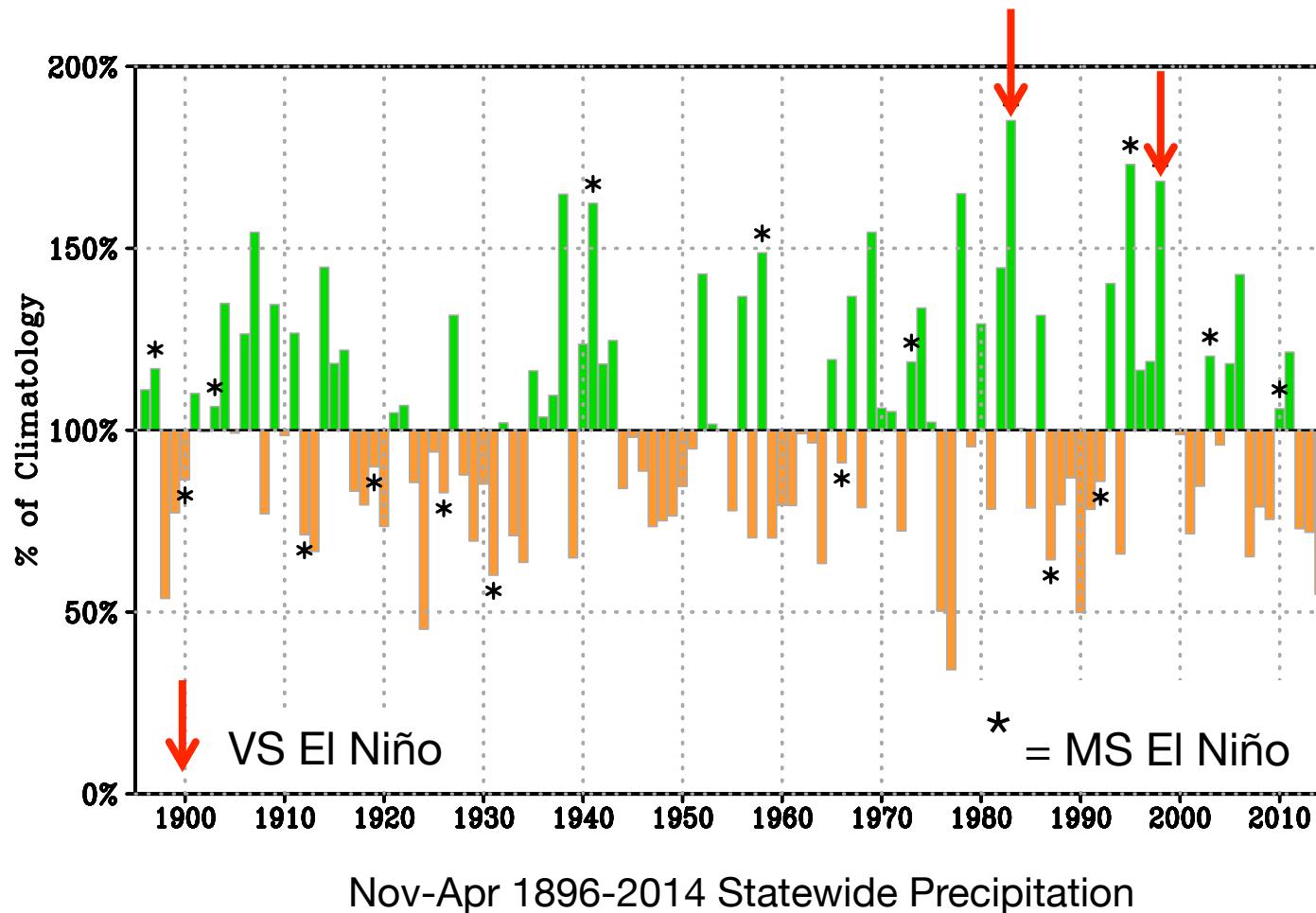
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CIRES/Univ. Colorado-Boulder



CA Rainfall During El Niño Is Mixed

Statewide Wet During the Two VS El Niño
Statewide Wet During Half MS El Niño



Questions

1. Is statewide November-April California wet symptomatic of the sensitivity to sea surface temperature (SST) forcing during very strong (VS) El Niño?
2. Is there a difference in impacts of VS El Niño and moderate-to-strong (MS) El Niño?
3. How do risks for wet vs. dry rainy season conditions change with El Niño?

Observed Data

- U.S. Climate Division Precipitation from Vose et al. 2014
- SST from Hurrell et al. 2008

Model Simulations

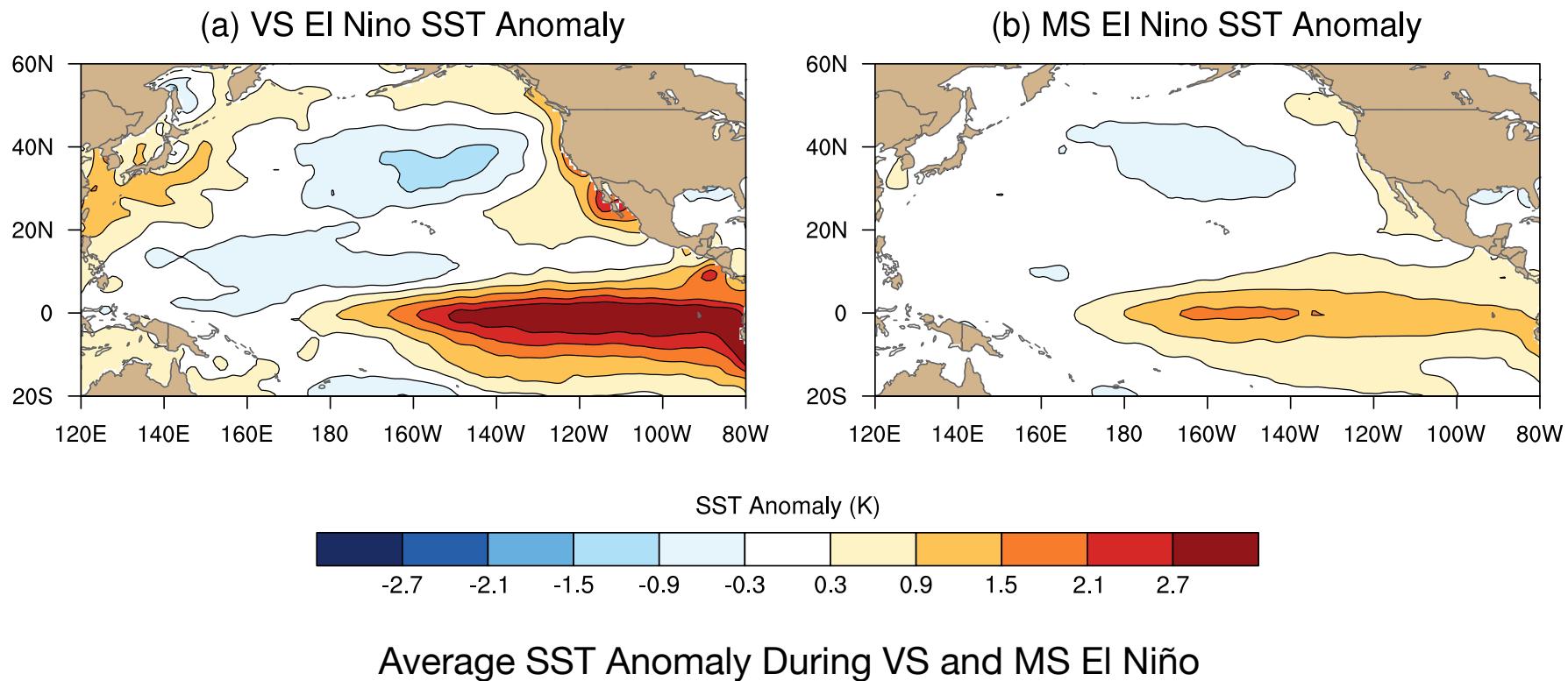
- Driven by observed monthly time-varying SST, sea ice, greenhouse gases and ozone for 1979-2014
- Three models and 130 ensembles
 - CAM5 – 50 ensembles
 - GFSv2 – 50 ensembles
 - ECHAM5 – 30 ensembles
- Aggregate all ensemble members
 - All models simulate similar regional California precipitation during ENSO

Define ENSO Events

- Centered On December-February Season
- ENSO Category Definition
 - VS El Niño: Niño3.4 > 2.0°C
 - MS El Niño: 2.0°C > Niño3.4 > 1.0°C

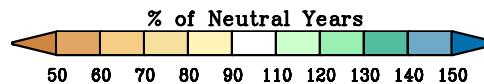
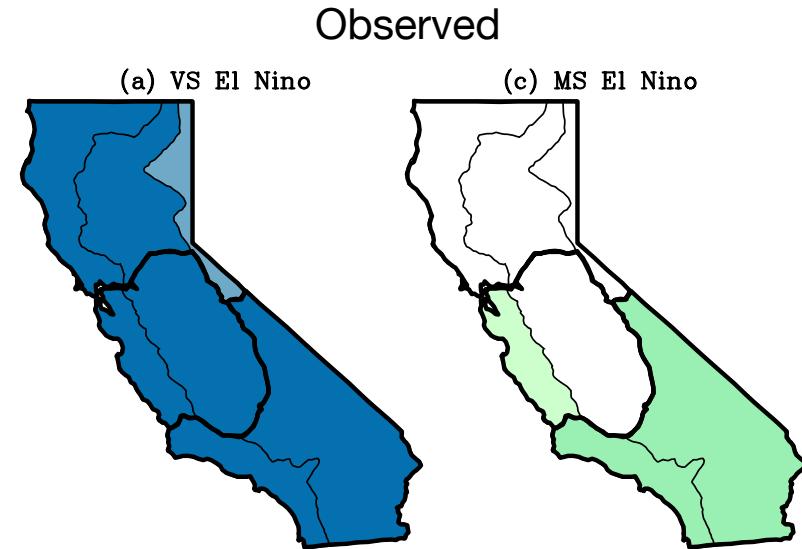
Category	January of Season
VS El Niño	1983, 1998
MS El Niño	1897, 1900, 1903, 1912, 1919, 1926, 1931, 1941, 1958, 1966, 1973, 1987, 1992, 1995, 2003, 2010

SST Anomalies During VS and MS El Niño Are Different



Strong Regional Rainfall Changes With VS El Niño

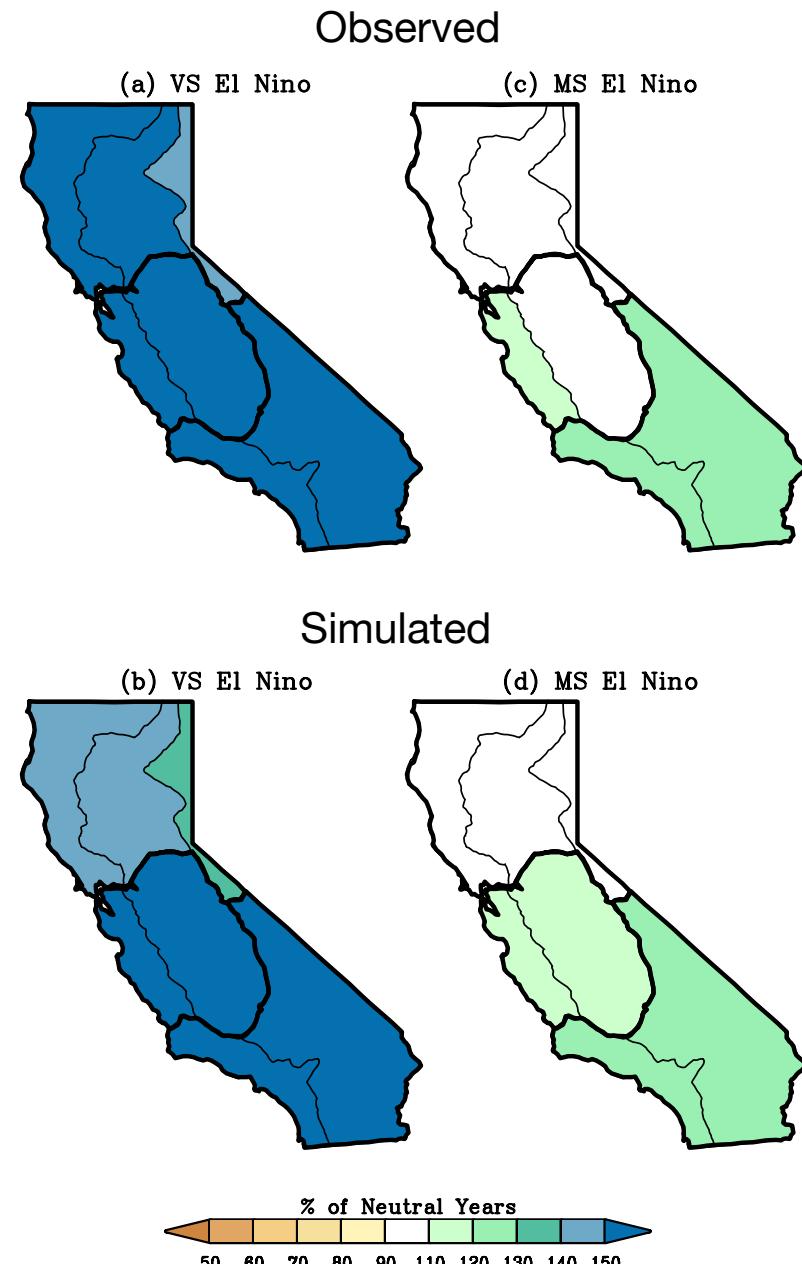
North and Central California sensitive to VS El Niño only



Nov-Apr Precipitation During El Niño

Strong Regional Rainfall Changes With VS El Niño

North and Central California sensitive to VS El Niño only



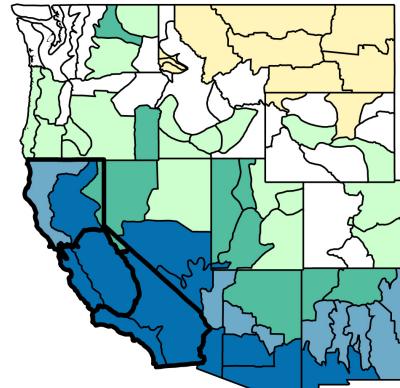
Nov-Apr Precipitation During El Niño

Strong Regional Rainfall Changes With VS El Niño

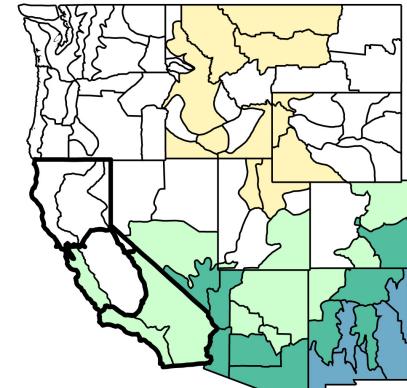
Southwest U.S. more sensitive to VS than MS El Niño

Observed

(a) VS El Niño

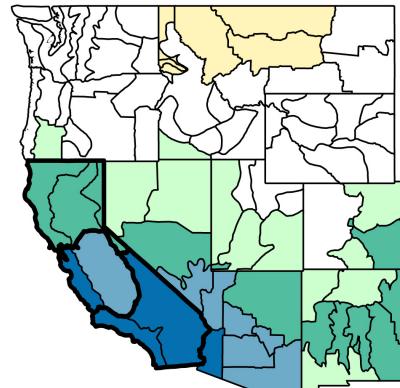


(c) MS El Niño

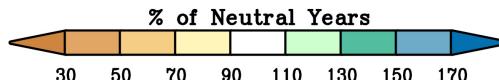
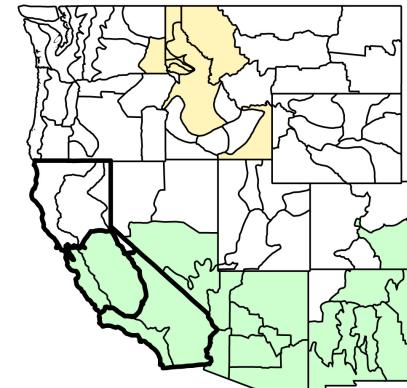


Simulated

(b) VS El Niño



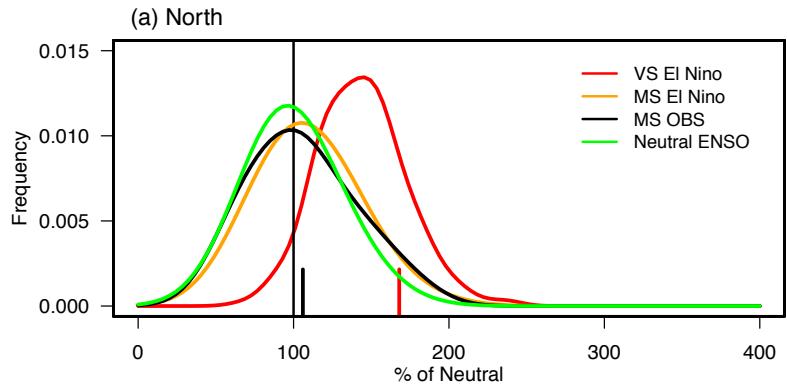
(d) MS El Niño



Nov-Apr Precipitation During El Niño

VS El Niño Shifts the Rainfall Odds Regionally

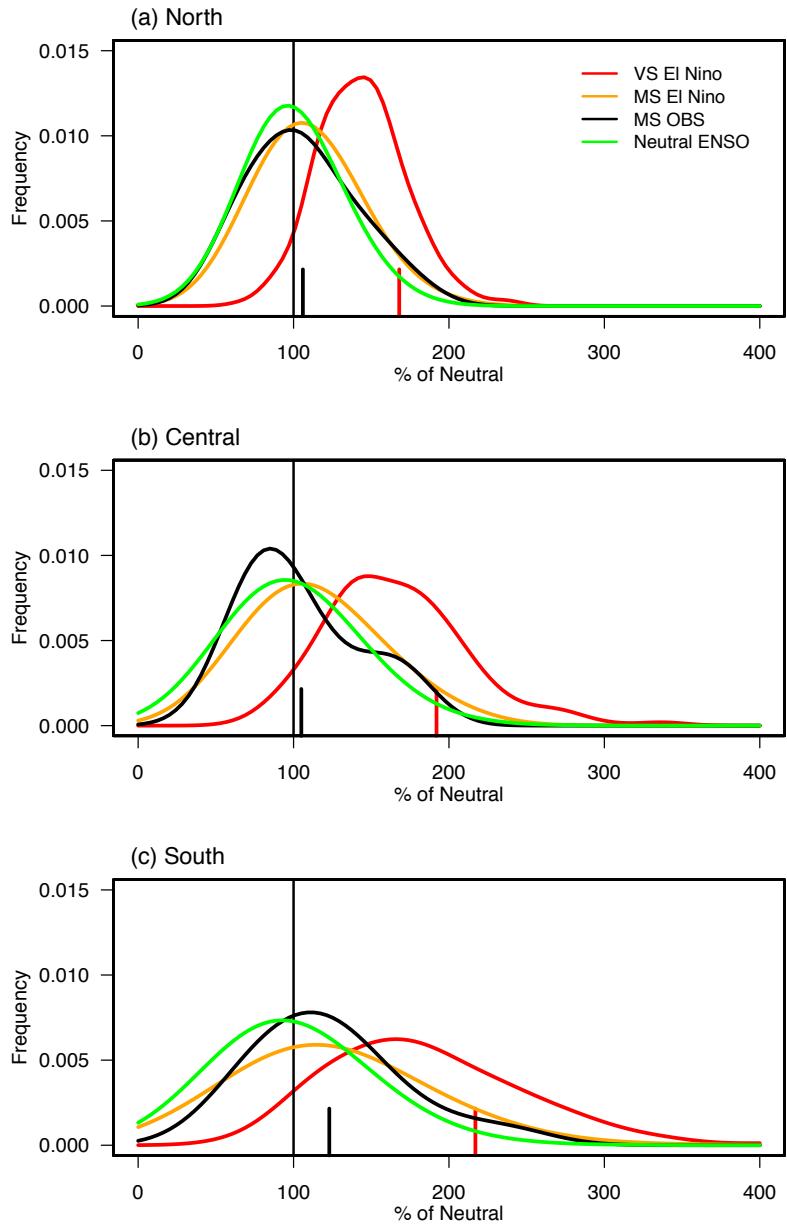
- North and Central California sensitive to VS El Niño only
- Overall shift to statewide wet conditions during VS El Niño



Nov-Apr PDF During El Niño

VS El Niño Shifts the Rainfall Odds Regionally

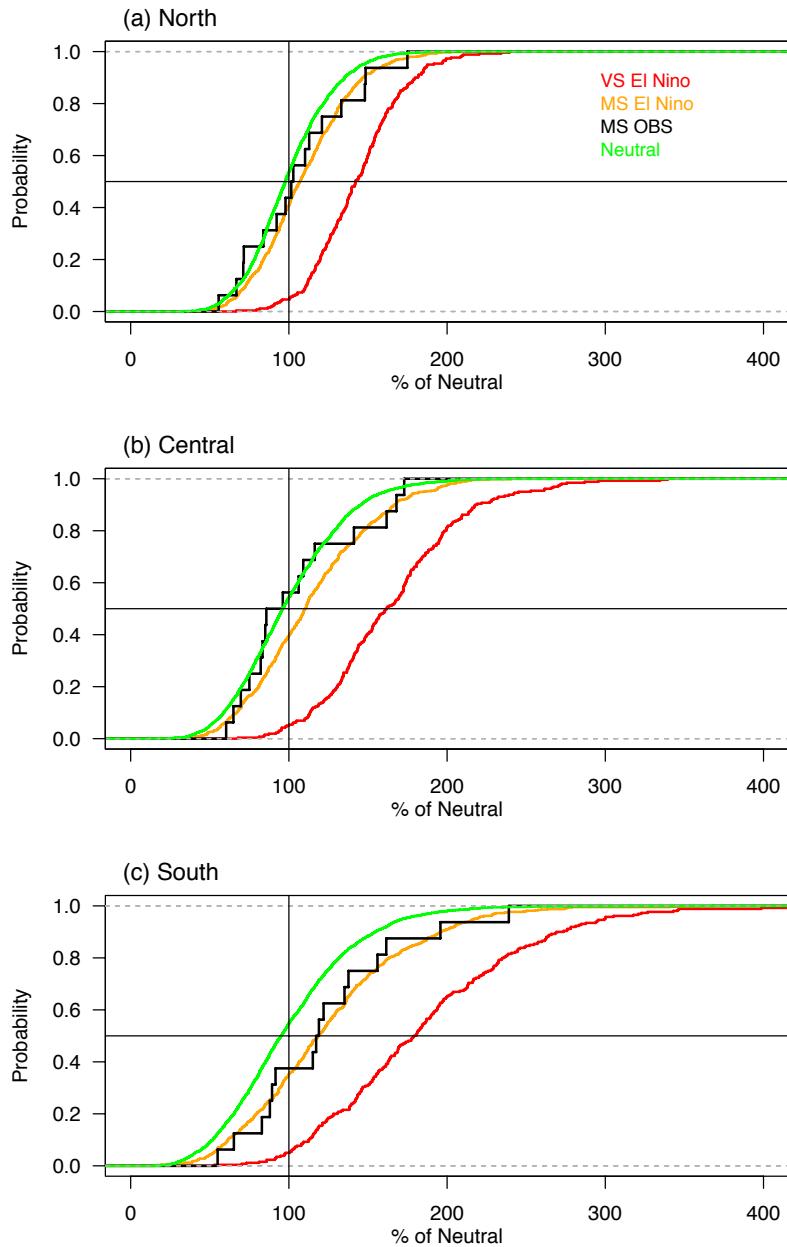
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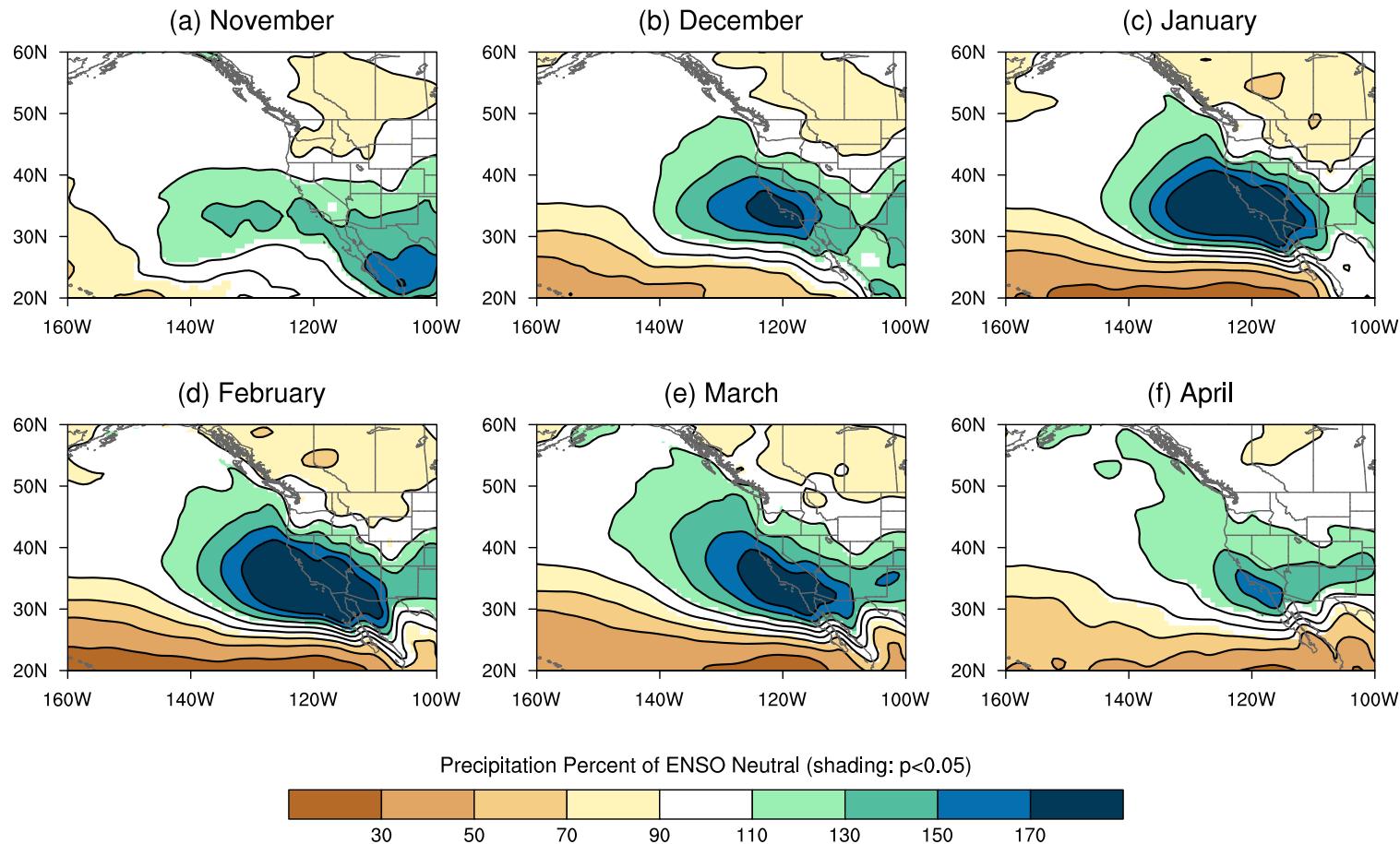
Nov-Apr PDF During El Niño

VS El Niño Nearly Eliminates Odds of Below Average Rainfall

- VS El Niño-driven regional below average rain is 5%
- VS El Niño significantly increases regional odds of 150% and 200% of normal

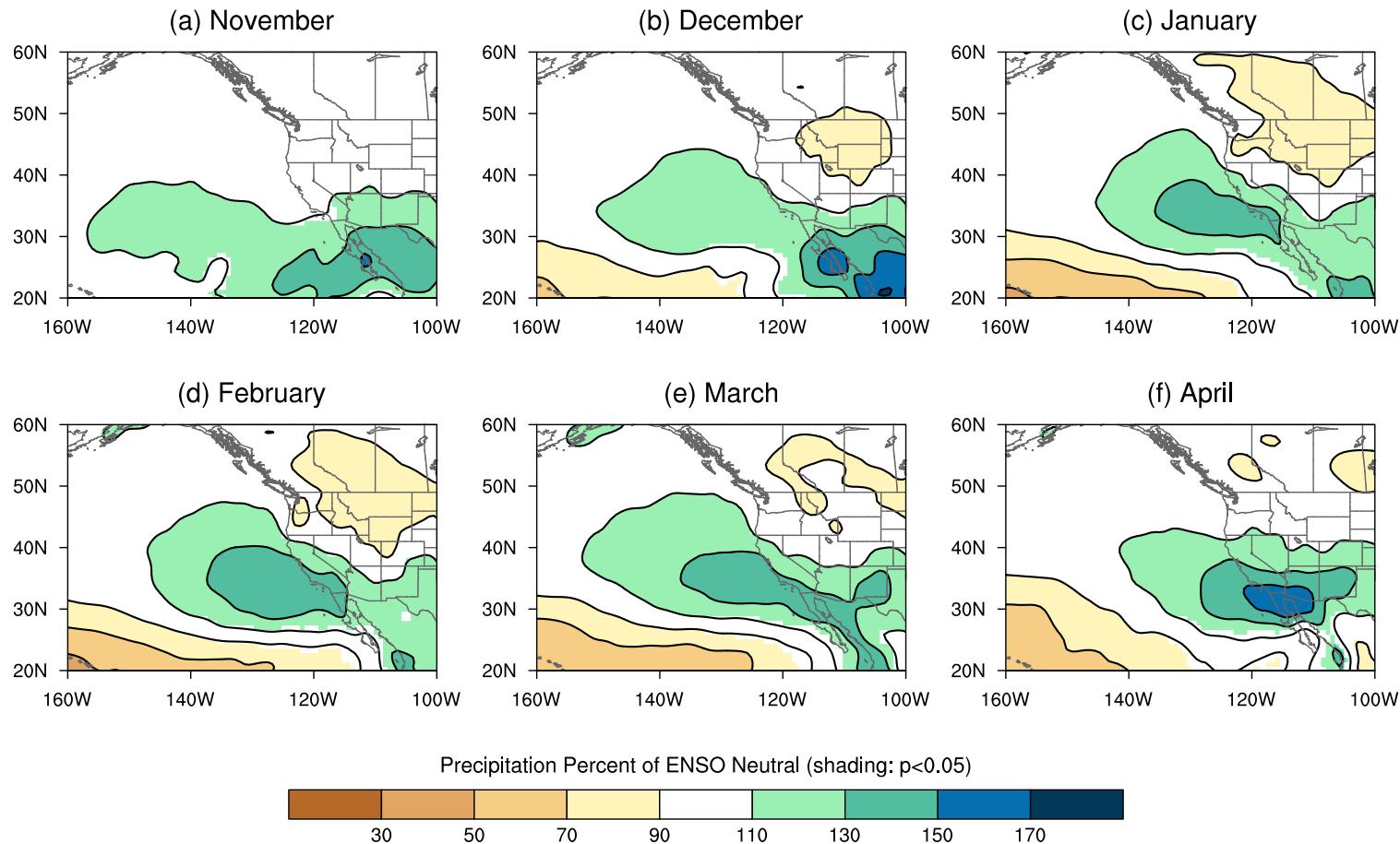


Midseason Maximum During VS El Niño



Monthly Model Simulation Precipitation During VS El Niño

Late Season Maximum During MS El Niño



Monthly Model Simulation Precipitation During MS El Niño

Questions

1. Is statewide California November-April wet symptomatic of the sensitivity to sea surface temperature (SST) forcing during very strong (VS) El Niño?

VS El Niño forces in excess of 130% of average precipitation

2. Is there a difference in impacts of VS El Niño and moderate-to-strong (MS) El Niño?

North and Central California is sensitive to only VS El Niño

3. How do risks for wet vs. dry rainy season conditions change with El Niño?

VS El Niño nearly eliminates the odds of below average November-April rainfall